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## PATENT ABSTRACTS OF JAPAN

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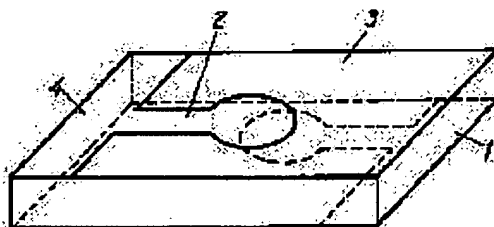
(72)Inventor : IKEDA HIROYASU

## (54) PIEZOELECTRIC RESONATOR

## (57)Abstract:

PROBLEM TO BE SOLVED: To improve the moisture-resistance performance by adopting a type of material whose surface contact angle is a specific angle or over for the piezoelectric resonator to improve the state of the surface of the piezoelectric substrate to have a hydrophobic property.

SOLUTION: A type of a material whose contact angle is 104° or over is adopted for a material of a surface 3 of the piezoelectric resonator 1. In this case, a vibration confinement electrode 2 is formed by applying a method such as vapor-deposition, printing or sputtering to a metal such as a silver and the contact angle of the vibration confinement electrode 2 is required to be 100° or over. Furthermore, in the case of conducting the surface treatment processing, when the condition of the contact angle to be 100° or over is not satisfied, deterioration is the characteristic is caused. When the contact angle of the surface 3 of the piezoelectric resonator 1 is 100° or over, no deterioration is caused. Since a hydrophobic property is provided to the surface 3 of the piezoelectric resonator 1 in this way, even when moisture is entered in the inside of the case, no condensation takes place on the surface 3 and then the deterioration in the characteristic is not caused.



## LEGAL STATUS

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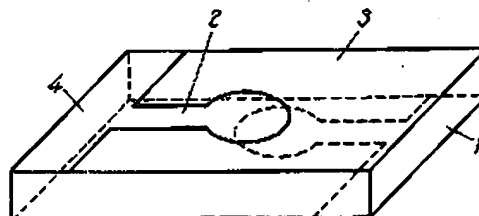
(54) 【発明の名称】 圧電共振子

(57) 【要約】

【課題】 本発明は圧電共振子に関するものであり、表面を疎水性にすることにより、耐湿性能の良い圧電共振子を提供することを目的とする。

【解決手段】 表面が $100^\circ$ 以上の接触角を有するセラミックまたは単結晶材質を用いて圧電共振子を形成する。また、 $100^\circ$ 以上の接触角を有しない材質を用いる場合は、表面の接触角が $100^\circ$ 以上となるよう表面処理を行う。

1 圧電共振子  
2 振動閉じ込め電極  
3 表面



(2)

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1

2

## 【特許請求の範囲】

【請求項1】 表面が $100^\circ$ 以上の接触角を有するセラミックスまたは単結晶材質よりなる圧電共振子。

【請求項2】 表面の接触角が $100^\circ$ 以上となるように表面の処理を行った圧電共振子。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明はセラミック共振子やフィルターなどに使用される圧電共振子に関するものである。

【0002】

【従来の技術】従来の圧電共振子は、セラミックスや単結晶部材により形成されているが、表面の接触角が $30^\circ \sim 50^\circ$ 程度であるため、この圧電共振子を実装したケース内部に湿気が浸入した場合、表面への水分の結露が容易に発生していた。

【0003】

【発明が解決しようとする課題】上記の従来の構成では、長時間の高温多湿中への放置によりケース内部に湿気が浸入した場合、圧電共振子表面が浸水性のため湿気が表面へ結露し、これにより圧電共振子の振動が阻害され、特性が劣化するという問題があった。

【0004】本発明は上記従来の問題点を解決するもので、表面状態を疎水性に改善することにより耐湿性能の良い圧電共振子を提供することを目的とする。

【0005】

【課題を解決するための手段】この課題を解決するために本発明の圧電共振子は、その表面の接触角が $100^\circ$ 以上である材質を用い、また材質の接触角が前記条件を満たさない場合は表面処理を施し表面の接触角を $100^\circ$ 以上向上させ、その表面を疎水性にすることにより表面への水分の結露を防止し、信頼性の高い共振子を提供するものである。

【0006】

【発明の実施の形態】本発明の請求項1、または2に記載の構成によって、圧電共振子表面を疎水性にしたため、ケース内部に湿気が浸入した場合でも、表面への湿気の結露が発生せず、特性劣化がおきないものとなる。

【0007】以下、本発明の実施形態について図を用いて説明する。

（実施の形態1）図1、図2に示す圧電共振子1は、表面3の接触角が $100^\circ$ 以上を有する材質を使用している。この場合、振動閉じ込め電極2は、銀などの金属を蒸着や印刷やスパッタ等の方式により形成しているが、この振動閉じ込め電極2の接触角も $100^\circ$ 以上ある必要がある。なお4は電極引出部である。

【0008】（実施の形態2）図3、図4に示す圧電共振子は、表面の接触角が $100^\circ$ 以上を有していないため（およそ、 $30^\circ$ 程度）前記圧電共振子1の表面に処理面5を設け、接触角を $100^\circ$ 以上に向上させたものである。ここで、接触角と耐湿性能の関係について図5に示す。図5は本発明による圧電共振子と従来の圧電共振子による耐湿試験 $60^\circ\text{C}95\%\text{R.H.}$ の特性の1000時間放置後の経時変化結果を示している。図5から明らかなように従来の圧電共振子Aの場合は特性の劣化が発生している。また、表面処理を行った場合でも、接触角が $100^\circ$ 以上の条件を満たさない場合Bは、同様に劣化が発生している。一方、圧電共振子表面の接触角が $100^\circ$ 以上の場合C、Dは劣化は発生していない。なお、接触角は $100^\circ$ 以上あれば接触角を増加しても、耐湿性に対する効果は同一である。また、接触角を向上させるための表面処理方法としては、疎水性の材質の塗布を行ったが、他の方法を用いて圧電共振子表面の接触角が $100^\circ$ 以上にすれば同様に効果がある。ただし、表面に任意の材質を塗布する方法を用いる場合は、その塗布膜厚に注意をしなければならない。つまり、膜厚が厚くなると圧電共振子の振動を阻害するため十分な初期特性を得ることができない。塗布する材質により前記膜厚の許容範囲は異なるが、振動閉じ込め電極2部ではおよそ $10\mu$ 以内がよい。

【0009】

【発明の効果】以上の説明からも明らかなように本発明は、圧電共振子を、表面の接触角が $100^\circ$ 以上である材質で形成、また材質の接触角が前記条件を満たさない場合は表面処理を施し表面の接触角を $100^\circ$ 以上に向上させることにより、圧電共振子表面への水分の結露を防止し、信頼性の高い共振子を提供するものである。

【0009】

【図面の簡単な説明】

【図1】本発明の一実施形態における圧電共振子の斜視図

【図2】同圧電共振子の断面図

【図3】本発明の他の実施形態における圧電共振子の斜視図

【図4】同圧電共振子の断面図

【図5】接触角と耐湿性能を示す図

【図面の簡単な説明】

【図1】本発明の一実施形態における圧電共振子の斜視図

【図2】同圧電共振子の断面図

【図3】本発明の他の実施形態における圧電共振子の斜視図

【図4】同圧電共振子の断面図

【図5】接触角と耐湿性能を示す図

【符号の説明】

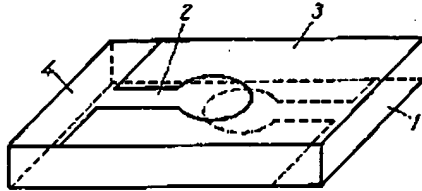
- 1 圧電共振子
- 2 振動閉じ込め電極
- 3 表面
- 4 電極引出部
- 5 処理面

(3)

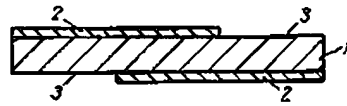
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【図1】

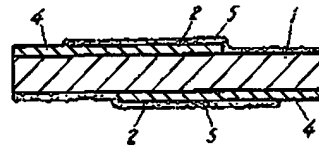
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2 振動開け込め電極  
3 表面



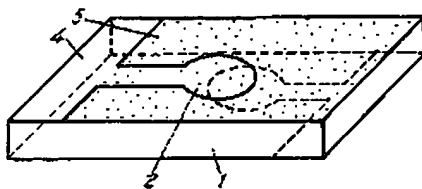
【図2】



【図4】

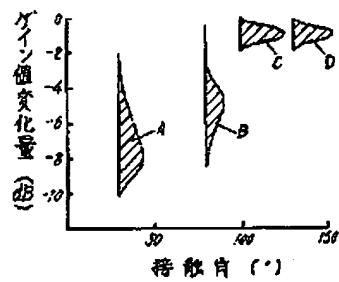


【図3】



【図5】

60°C 95% R.H. 1000h 放置



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the piezo resonator used for a ceramic radiator, a filter, etc.

[0002]

[Description of the Prior Art] Although the conventional piezo resonator was formed of the ceramics or a single crystal member, since a surface contact angle was about 30-50 degrees, when moisture infiltrated into the interior of the case which mounted this piezo resonator, dew condensation of the moisture to a front face had occurred easily.

[0003]

[Problem(s) to be Solved by the Invention] With the above-mentioned conventional configuration, when moisture infiltrated into the interior of a case by neglect into prolonged heat and high humidity, since a piezo-resonator front face was flooding nature, moisture dewed to the front face, the oscillation of a piezo resonator was checked by this, and there was a problem that a property deteriorated.

[0004] This invention solves the above-mentioned conventional trouble, and it aims at offering the good piezo resonator of damp-proof ability by improving a surface state to hydrophobicity.

[0005]

[Means for Solving the Problem] In order to solve this technical problem, using the construction material whose contact angle of that front face is 100 degrees or more, when the contact angle of construction material does not fulfill said conditions, the piezo resonator of this invention performs surface treatment, raises a surface contact angle at 100 degrees or more, by making that front face into hydrophobicity, prevents dew condensation of the moisture to a front face, and offers a reliable resonator.

[0006]

[Embodiment of the Invention] Even when a piezo-resonator front face is written to hydrophobicity and moisture infiltrates into the interior of a case by the configuration given in claims 1 or 2 of this invention, dew condensation of the moisture to a front face does not occur, but there is [ no property degradation sets and ].

[0007] Hereafter, the operation gestalt of this invention is explained using drawing.

(Gestalt 1 of operation) The piezo resonator 1 shown in drawing 1 and drawing 2 is using the construction material in which the contact angle of a front face 3 has 100 degrees or more. In this case, although the oscillating \*\*\*\*\* electrode 2 forms metals, such as silver, with methods, such as vacuum evaporation, printing, and a spatter, the contact angle of this oscillating \*\*\*\*\* electrode 2 also has 100 degrees or more of a certain need. In addition, 4 is the electrode drawer section.

[0008] (Gestalt 2 of operation) Since the surface contact angle does not have 100 degrees or more (about about 30 degrees), the piezo resonator shown in drawing 3 and drawing 4 establishes the processing side 5 in the front face of said piezo resonator 1, and it raises a contact angle at 100 degrees or more. Here, the relation between a contact angle and damp-proof ability is shown in drawing 5. Drawing 5 shows

the aging result after 1000-hour neglect of the property of 60 degrees-C 95%[ of humidity resistance tests ] R.H. by the piezo resonator by this invention, and the conventional piezo resonator. In the case of the conventional piezo resonator A, degradation of a property has occurred so that clearly from drawing 5 . Moreover, when surface treatment is performed, and a contact angle does not fulfill conditions 100 degrees or more, degradation has generated B similarly. On the other hand, when the contact angle on the front face of a piezo resonator is 100 degrees or more, C and D have not generated degradation. In addition, if there are 100 degrees or more of contact angles, even if it will increase a contact angle, the effectiveness over moisture resistance is the same. Moreover, as the surface treatment approach for raising a contact angle, although hydrophobic construction material was applied, if the contact angle on the front face of a piezo resonator becomes 100 degrees or more using other approaches, there is effectiveness similarly. However, when using the approach of applying the construction material of arbitration to a front face, it must be cautious of the application thickness. That is, since the oscillation of a piezo resonator will be checked if thickness becomes thick, sufficient initial property cannot be acquired. Although the tolerance of said thickness changes with construction material to apply, in the oscillating \*\*\*\*\* electrode 2 section, less than 10micro is about good.

[0009]

[Effect of the Invention] When formation and the contact angle of construction material do not fill said conditions with the construction material whose surface contact angle is 100 degrees or more about a piezo resonator, by performing surface treatment and raising a surface contact angle at 100 degrees or more, this invention prevents dew condensation of the moisture on the front face of a piezo resonator, and offers a reliable resonator, so that clearly also from the above explanation.

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CLAIMS

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[Claim(s)]

[Claim 1] The piezo resonator which a front face becomes from the ceramics or single crystal construction material which has a contact angle 100 degrees or more.

[Claim 2] The piezo resonator which processed the front face so that a surface contact angle might become 100 degrees or more.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The perspective view of the piezo resonator in 1 operation gestalt of this invention

[Drawing 2] The sectional view of this piezo resonator

[Drawing 3] The perspective view of the piezo resonator in other operation gestalten of this invention

[Drawing 4] The sectional view of this piezo resonator

[Drawing 5] Drawing showing a contact angle and damp-proof ability

[Description of Notations]

1 Piezo Resonator

2 Oscillating \*\*\*\*\* Electrode

3 Front Face

4 Electrode Drawer Section

5 Processing Side

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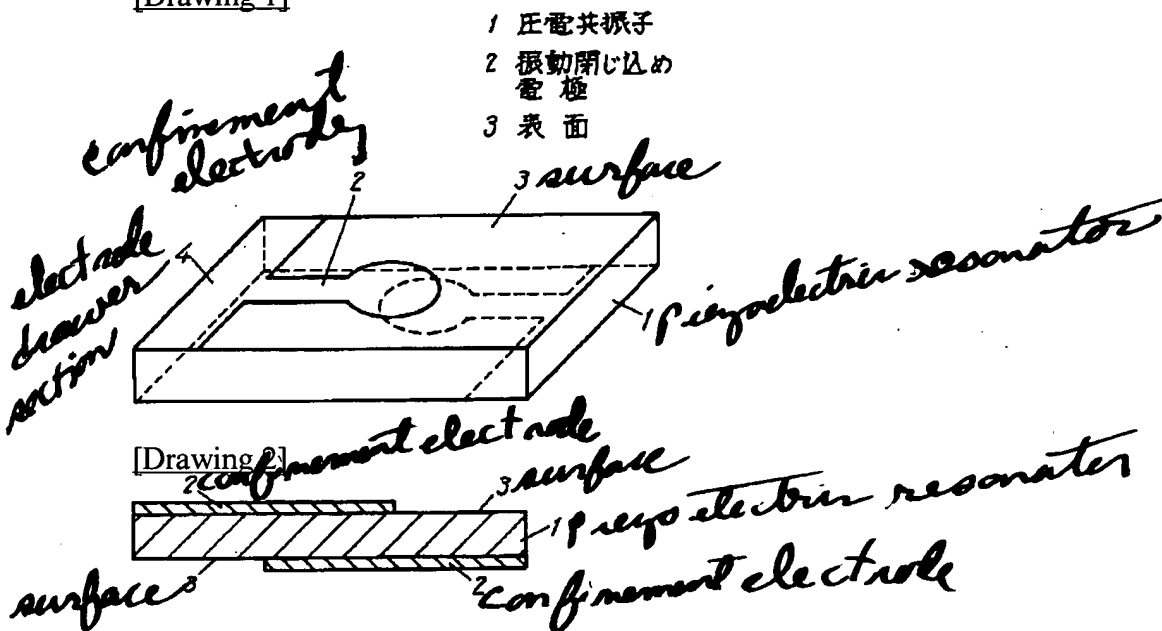
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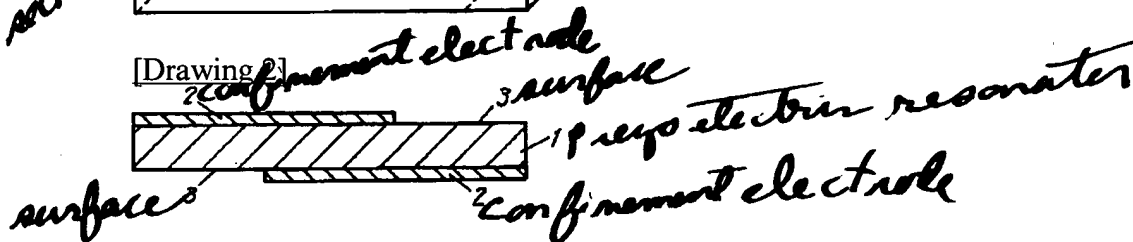
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## DRAWINGS

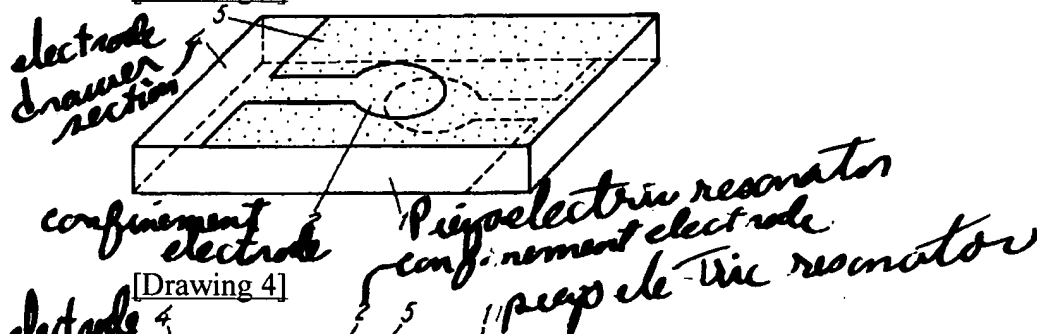
[Drawing 1]



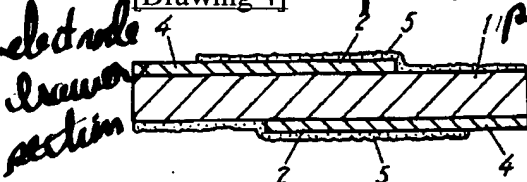
[Drawing 2]



[Drawing 3]

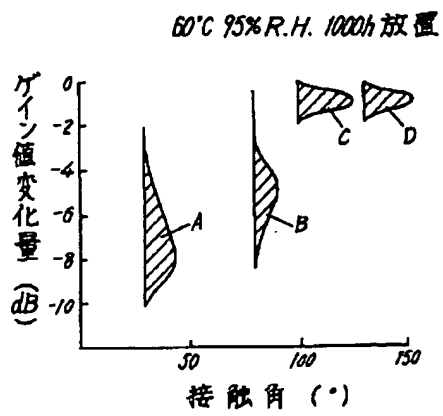


[Drawing 4]



[Drawing 5]





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